Internationalization, Integration of Citizen Science and Inquiry-Based Learning with GLOBE at UoC

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Content

1. Why doing GLOBE at Universities?
2. Internationalization with GLOBE
3. GLOBE related Research
4. SmartPhone Apps, ENERLE and LEAPs
Key goals of teacher education in Germany ... can be expressed as the 6 “I”s.
GLOBE supports the 6 “I”s particularly well

- The Scientific Method
  - Inquiry-based Learning
- International
  - International Network of Educators and Researchers
- Identify
  - Place-based learning motivates participation
- Interdisciplinarity
  - STEM Disciplines
  - Languages
  - Direct links to school curricula
  - Links Science to Schools
- Inclusion
  - Offers opportunities for Citizen Science participation
UoC’s Concept: GLOBE provides links to UoC’s skills labs
The backbone of the GLOBE Program is the scientific research process.
An example of inquiry-based learning using GLOBE data

What is the difference between surface temperature measured with an IR thermometer and air temperature?

Scientific Research Process

- Observe Nature
- Pose Questions
- Develop Hypothesis
- Plan Investigation
- Assemble Data
- Analyze Data
- Document Conclusions
- Present Findings
- Pose New Questions

What is the difference between surface temperature and air temperature?

Surface temperatures have larger annual amplitudes

Measure surface temperature and air temperature or search GLOBE database

Retrieve the data and transfer them into a form suitable for analysis
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Measure surface temperature and air temperature or search GLOBE database.

Retrieve the data and transfer them into a form suitable for analysis.

Select suitable, graphical, tabular, and statistical analyses.

Often teachers and students lack experience working with spreadsheets and thus to utilize data in the GLOBE database.
The DataEv.xlsx spreadsheet provides an easy two step approach to basic data analysis

Step 1: Use the DataEv.xlsx workbook and copy the downloaded GLOBE data to the Excel sheet DS1 and/or DS2

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</table>
The DataEv.xlsx spreadsheet provides an easy two step approach to basic data analysis

Step 2: Select the appropriate data for analysis by filling the cells marked in green
Check the results: as tables
Check the results: as histograms
Check the results: as relationships
Check the results: as graphs

Media competence is a critical skill for students and citizen alike

The amplitudes shown here look like they are the same. It is easy to cheat with graphs.
GLOBE provides an established platform for international cooperation

- UoC is continuing to work on establishing a University Network of Science Education and Research (UNSER)

GLOBE Countries and Member's Map
Student exchange and research theses in the GLOBE context so far

6 ongoing theses
3 completed theses

Exchange Students
Bachelor thesis
Master thesis

Exchange Students

Exchange Students
Bachelor thesis
Research example in the frame of the GLOBE cooperation: Validation of SMAP Soil moisture products

Soil Moisture Pattern Analysis using SAR data and Modelling (www.tr32.de)
Study programmes at the Institute of Geography provide many options for international exchange

- Geography (BSc and MSc) – in German
- Geography (BA and MA) – in German
- Geography (BAGG and MEd) – in German
- IMES (International Master of Environmental Sciences) (MSc) – in **English**
- QSGA (Quaternary Research and Geoarchaeology) (MSc) – in German
- CEA (Culture and Environment in Africa) (MA) – in **English**
Courses in English – Institute of Geography

Winter term 2017/2018:

• Geography of South Asia (lecture)
• Physical Hydrology (lecture)
• Changing African environments (lecture)
• Hydrology and risk (seminar)
• Man – environment interactions in the Global South (seminar)
• Land cover change and land resources assessment (seminar)
• Coastal environments in the Global South: Environmental change and management (seminar)
• Global commodity chains and multinational corporations (10-day field practical in Capetown, South Africa)
• Catchment Hydrology – basic concepts and ecohydrological modelling (practical)
GLOBE Lecture series and more...

• Understanding Science through Inquiry Based Learning and Participation (Lecture and Seminar)
• Statistical analysis of environmental data (Seminar)
• ...

Support for Incomings at the Institute

http://www.geographie.uni-koeln.de/14517.html?&L=1
International Coordination & Counselling

Coordinator of International Exchange Programs
Dr. Verena Dlugoss
verena.dlugoss@uni-koeln.de

First inquiry and support in organisational matters
MSc Lara Schmalohr
lschmal1@uni-koeln.de

Geography-international@uni-koeln.de

http://www.geographie.uni-koeln.de/13264.html
Q: The GLOBE program has strengthened my interest in international cooperation and/or bilingual teaching approaches

Number of responses

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<th>Response</th>
<th>Number</th>
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<tr>
<td>2. mostly agree</td>
<td>3</td>
</tr>
<tr>
<td>3. neither agree</td>
<td>1</td>
</tr>
<tr>
<td>4. mostly disagree</td>
<td>0</td>
</tr>
<tr>
<td>5. disagree</td>
<td>0</td>
</tr>
</tbody>
</table>

N = 11
Exposure and experiencing strengthens the interest in further pursuing interdisciplinary cooperation

Q: The GLOBE program has shown opportunities for interdisciplinary cooperation which I would like to pursue further

Number of responses

1. agree
2. mostly agree
3. neither agree nor disagree
4. mostly disagree
5. disagree

N = 11
IBL is perceived by most students as a very suitable teaching and learning approach

Q: The GLOBE has inspired me to apply inquiry-based learning approaches in the future.

Number of responses

- 1. agree: 6
- 2. mostly agree: 3
- 3. neither agree nor disagree: 2
- 4. mostly disagree: 0
- 5. disagree: 0

N = 11
Extending the GLOBE idea by integrating citizen science: The use of smartphones in place-based teaching approaches

Cooperative research project:

Monitoring the environment with smartphones: Participation in environmental sciences as motivator for STEM disciplines and citizen participation

**STEM in High Schools**

Prof. Karl Schneider  
Geographical Institute

**STEM in Elementary and Junior High Schools**

Prof. André Bresges  
Institute for Physics Education

**Citizen Participation**

Prof. Lars Ribbe  
Institute for Technology and Resource Management in the Tropics and Subtropics

**Funded by:**

[Logo] RheinEnergie Stiftung  
Jugend | Beruf  
Wissenschaft

Technology  
Arts Sciences  
TH Köln
The project approach

Goal
• Analyze existing and develop new approaches for using smartphones in STEM disciplines and to foster participation in environmental research

Target groups
• Students in schools and universities
• Citizens

Hypotheses
• Smartphones offer opportunities for participation and to strengthen societal engagement,
• The use of smartphones provides a suitable motivator to teach STEM disciplines,
• Open access to data provides useful information for research
• Communicating and participating in science strengthens trust in science

Method
• Analysis of existing apps
• Development of an integrated concept for the use of smartphones in education
• Implementation
• Evaluation
GeoODK was identified as a very versatile tool to develop customized apps for place-based education.
Integrating place-based information, activation, and explanation is particularly motivating for participation.

The ENERLE concept: Endecken, Erklären, Lernen

Step 1: Establish a trademark

Step 2: Motivate

Step 3: Inform

Step 4: Activate

Step 4: Explain and Encourage

ENERLE

Explore Nature,
Explain through Research,
Learn in your Environment.

FLEHBACH IM KÖNIGSFORST - MENSCHGEMACHTE NATUR?

Step 1: Establish a trademark

Step 2: Motivate

Step 3: Inform

Step 4: Activate

Step 4: Explain and Encourage

ENERLE
Smartphone apps used with ENERLE

- **BBCH Phenology**
  - Welcome to the phenology app

- **LandCover**
  - Welcome to the vegetation mapping app

- **RiverMon**
  - Welcome!

- **Bodentyp bestimmen**
  - Willkommen zur Bodentyp Bestimmungs App.
  - Dieses Kartierungswerkzeug basiert auf der "Bodenkundlichen Kartieranleitung".

- **Bodenartbestimmung**
  - Willkommen zur Bodenart Kartierungs-App.
  - Dieses Kartierungswerkzeug basiert auf der "Bodenkundlichen Kartieranleitung".

- **Wolkenbeobachtung**
  - Willkommen zum Wolkenbeobachteter Protokoll.
ENERLE occurs in LEAPs: LEAPs are Learning, Exploring and Activity Paths

**Flebach LEAP**

**Trail Marker**

**Motivate and Inform**

**Activate**

**ENERLE**

Welcome to the Flebach trail
Do you want to learn and explore interesting things about this site?
Please go to site: www..... or scan the QR code with your smartphone

**FLEHBACH IM KÖNIGSFORST - MENSCHGEMACHTE NATUR?**

Der Kurschnitt der mobilen Kommunikationstechnologie und die Omnipräsenz von Smartphones werden genutzt, um im Flechbach/Oberkönigsforst den Spuren des Flechbachs zu folgen.

Im Osten von Köln/Nord der Flechbach entwickelt sich im Flussbett jährlich ein aufsten umsetzender Siedlungsraum. Die Flechbachsteine können nicht nur der Platz der Stadt, sondern auch der Fluss selbst sein. Die Steine werden von den Menschen und ihren Bewohnern genutzt, um ihre Bauten und Häuser zu errichten.


**BBCH Phenology**

*BBCH 1: Which description below describes the phenological stage best?*

If there is no choice available, the phenology for this plant is not implemented yet. Continue with stage 0 until.

- Germination
- Leaf development
- Tillering
Explain and cooperate

Measurement places are shown on map

Data are provided in tables

Photos are used for documentation and quality control

Charts can be used to document student activity
The student assessment of the use of apps during an excursion was very favorable.

- The use of apps strengthens my observation abilities: 20 occurrences
- The use of apps strengthens my active participation: 18 occurrences
- The use of apps helps to clearly document my observation: 14 occurrences
- The design of the apps helps to understand the observation methods: 11 occurrences

Total respondents: N = 33
The student assessment of the use of apps during an excursion was very favorable.

- I would use the apps also beyond the mandatory classes (e.g. on my travels/trips): 18
- Providing the data motivates to make accurate observations: 9
- Providing the data motivates me to participate: 9
- Traditional monitoring methods are superior to apps: 1
- Traditional monitoring methods are superior to apps: 4
- Traditional monitoring methods are superior to apps: 0
- Traditional monitoring methods are superior to apps: 0
- Traditional monitoring methods are superior to apps: 3

N = 33
Conclusions

• Internationalization in the frame of GLOBE is rather attractive for pre-service teacher education
• Internationalization at home is just one option
• Building a comparable course program (e.g. based on GLOBE) helps to ease international exchange
• IBL with GLOBE is particularly attractive for our students
• Utilizing the large GLOBE data base is often difficult to students and teachers alike: Simple tools (e.g. DataEv.XLSX) can help
• Smartphones and the GeoODK toolbox provide great tools
  • to support place- and inquiry-based learning
  • to activate students and citizen
  • to experience scientific procedures
  • to foster participation and cooperation
  • to extend the GLOBE concept
This project aims at developing new approaches to participate environmental discovery and research by addressing two target groups: a) students and b) citizen. Particularly schools are central institutions in strengthening the notion of the importance and enjoyment of contributing to common societal tasks.

The guiding hypothesis of this project is that smartphone apps customized for the needs of the different target groups will:

1. strengthen the willingness to participate in environmental research projects,
2. motivates for STEM disciplines,
3. provides useful data for environmental research and
4. strengthens by doing science the trust in scientific methods and supports the notion of the importance of science.

Due to the ever increasing communication device, educational tool or merely as backdrop of the technologies, rather relevant to motivate interdisciplinarily, interdisciplinary, interdisciplinary, flood prevention.

Here are first prototypes of educational apps covering issues such as:

- River Monitoring
- Land use and land cover mapping as well as Phenology
- Soil texture determination and Soil type identification
- Cloud identification

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